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IMPORTANT INSECT ENEMIES OF SOUTHERN PINES^{1/}

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This number of the SOUTHERN FOREST PEST REPORTER brings together the latest information on the identification, habits, and control of the more important insect enemies of southern pines. It is intended to provide wider dissemination of material now being used both to train cooperators in the forest insect detection program and as a guide to foresters in the field.

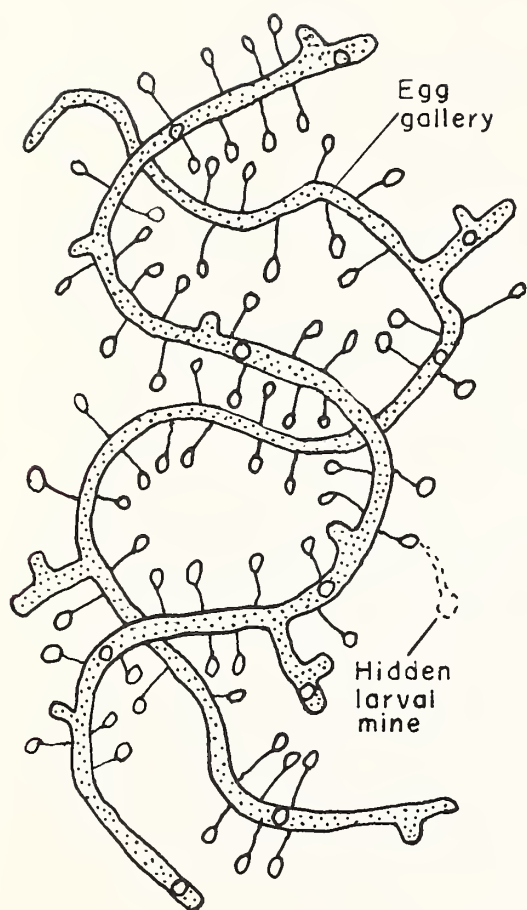
Not all of the insect pests of pines are included. Certain species, although common or destructive locally and periodically, have been omitted for various reasons. For example, the Texas leaf-cutting ant of east Texas and Louisiana is readily recognized by those concerned with it. Pine webworms are frequently observed on seedlings, but are seldom important enough to warrant the cost of control.

Material on destructive hardwood insects will be distributed when more information concerning them becomes available.

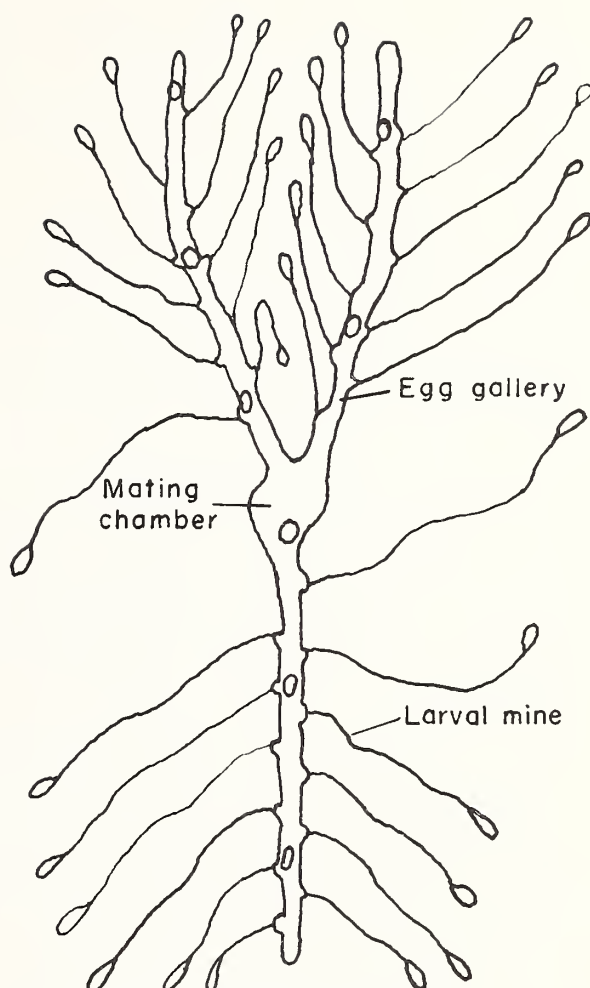
^{1/} Published and unpublished information accumulated by entomologists formerly or presently employed by the Southern Forest Experiment Station has been freely drawn upon in compiling this publication.

Table 1. --Important pine insects of the South

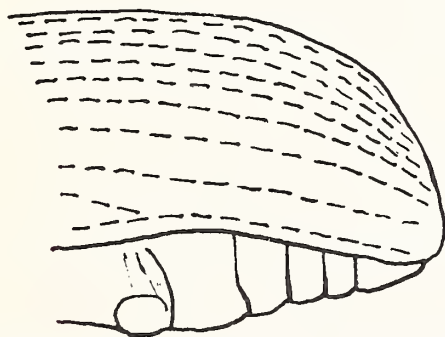
Insect	Importance	Symptoms
<u>Southern Pine Beetle</u> Bores under bark and girdles trees of commercial size. Usually attacks middle of trunk and spreads up and down.	Considered the most important insect of southern pines. Should be constantly looked for in dying timber. Like fire, it must be detected early and snuffed out immediately. Once out of control, this pest can kill millions of dollars worth of green timber. Outbreaks are especially likely during and after drouths, wind and hail storms, and fire.	Small, reddish to white pitch-tubes on bark. Sometimes just boring dust. S-shaped and criss-crossed tunnels engraved in inner bark (fig. 1). Beetles brown to black, about 1/8-inch long; rounded hind end (fig 1); minute notch on front of head when viewed from above (fig. 2, p. 5).
<u>Ips Engraver Beetles</u> Bore under bark and girdle trees of small and commercial size. One species attacks crowns, another the middle trunk, a third the lower trunk.	Ips beetles are common on scattered dying and dead trees throughout the forest. Following drouths, fires, windfall, and logging, populations increase and kill weakened trees that might otherwise live. Beetles carry a blue stain fungus that reduces value of lumber. Not as spectacular as the southern pine beetle but with us all the time and do considerable damage.	Small, reddish to white pitch-tubes on bark of trunk. Sometimes just red boring dust in cracks of bark and on ground. Y- or H-shaped tunnels, almost straight and parallel with wood grain, on inside bark (fig. 1). Beetles light to dark brown, 1/4-inch long or less; hind end cut-off and shovel-shaped (fig. 1).
<u>Black Turpentine Beetle</u> Girdles inner bark of stumps and butts of large trees. Also attacks large roots for several feet below ground.	Normally of moderate importance, boring in stumps and the base of living trees, not killing them. Following logging, fires, etc., the insect may increase and kill trees, especially trees that have been scarred or otherwise damaged.	Large sugar-like pitch tubes on stumps and lower trunk. Hard particles of resin at tree base. Tunnels on inner bark are more or less shapeless, and contain considerable pitch; larvae feed in groups and eat out whole patches of inner bark. Beetles brown to black, about 1/4- to 1/3-inch long.
<u>Pales Weevil and related species</u> External bark feeders and girdlers of seedlings.	Weevils are attracted to odor of fresh stumps, slash, and burned trees, and feed on seedlings in vicinity. They breed in stumps and roots of larger trees and the new adults again feed on nearby seedlings.	Planted or natural seedlings with bark girdled externally above ground line, especially in vicinity of recent cutting operations. Weevils dark brown to black, 1/4- to 1/2-inch long; prominent beak; feed at night and in cloudy weather.
<u>Pine Tip Moth</u> Bud and shoot destroyer of seedlings and saplings.	Larvae hollow out and kill buds and shoots of young pines, causing the tree to become bushy and stunted. In severe attacks, especially on poor sites, the trees die.	Undeveloped buds and dead shoots hollowed out. White crust of resin near bud. Small, yellowish to brown larvae with dark brown heads, inside bud or shoot. Moth about 1/4-inch long, reddish brown with silver-gray markings. Flies around foliage during summer.
<u>Red-headed Pine Sawfly</u> Needle chewer.	Common plantation pest but usually remains local. Trees are weakened and occasionally killed by repeated defoliation.	Needles chewed to short stubs; manure pellets on ground. Masses of worm-like larvae feeding together; red-brown heads, yellow bodies with black spots; about an inch in length; many small legs.
<u>Loblolly Pine Sawfly</u> Needle chewer.	Prefers loblolly pine. Defoliates pines from March to May, causing heavy growth losses.	Needles chewed and trees defoliated, manure pellets on ground. Groups of worm-like larvae up to about an inch in length; red-brown heads; bodies dull green and gray striped; many small legs on body. Difficult to see on foliage.
<u>Black-headed Pine Sawfly</u> Needle chewer.	Defoliates pines.	Larvae same as above except with black heads and black spots along sides of green and gray striped body.
<u>White Grubs</u> Root feeders on nursery seedlings and young plantation stock.	Often kill nursery seedlings by destroying roots. Also harm young plantations on sodland.	Foliage of seedlings fading and dying. Roots girdled or chewed off. White grubs in soil near roots.



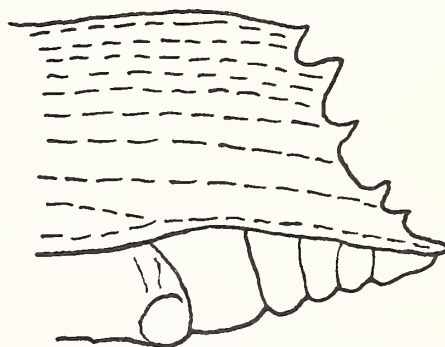
TUNNELS OF SOUTHERN PINE BEETLE ON INNER BARK (x 1).



TUNNEL OF *IPS* BARK BEETLE ON INNER BARK (x 1).



SIDE VIEW OF HIND END OF SOUTHERN PINE BEETLE (GREATLY ENLARGED).



SIDE VIEW OF HIND END OF *IPS* BEETLE (GREATLY ENLARGED).

Fig. 1.—Distinguishing features of southern pine beetle and *Ips* beetles.

SOUTHERN PINE BEETLE

Dendroctonus frontalis

Importance. -- The southern pine beetle is considered to be the most destructive forest insect in the South. It attacks pines of pulpwood size and larger and can kill apparently vigorous trees. It is especially dangerous following prolonged drouth or after windstorms or fire, but sometimes it reaches epidemic status without obvious reason.

The beetle carries with it a blue stain fungus that hastens the death of trees and lowers their lumber value.

Habits. -- The beetle is about 1/8-inch long, brown or black. Its hind end is rounded, in contrast to the chopped-off posterior of Ips beetles (fig. 1). When the beetle is viewed from above with a hand lens, a minute notch may be seen on the front of the head (fig. 2).

The beetles construct S-shaped, criss-crossed tunnels in the inner bark and kill the tree by girdling it. Eggs are laid in the tunnels and larvae soon develop from them. Larvae feed within the bark, change to pupae, and finally transform to new adult beetles. In warm weather the life cycle is completed in 30 to 40 days. There may be 5 or 6 generations a year.

The beetle kills trees in groups that vary in size from a few trees to many thousands. Population trends are violent and hard to predict. Buildups are fast and sometimes without apparent reason. When the epidemic has run its course, the insects often disappear as rapidly as they came; in some years it is almost impossible to find any beetles at all.

Signs of attack. -- The earliest signs of infestation are numerous white, yellow, or red-brown pitch tubes, about as large as a wad of gum, scattered over the bark of the main stem. In trees of low vigor, pitch tubes may be lacking but reddish boring dust will be seen in bark crevices and in spider webs on the bark and at the base of the trees.

New broods often leave the trees before the foliage fades. When the crowns turn red, the beetles have left (except during winter).

Control. -- When beetle populations are rising, control measures should be applied immediately and pushed forward vigorously. Salvage

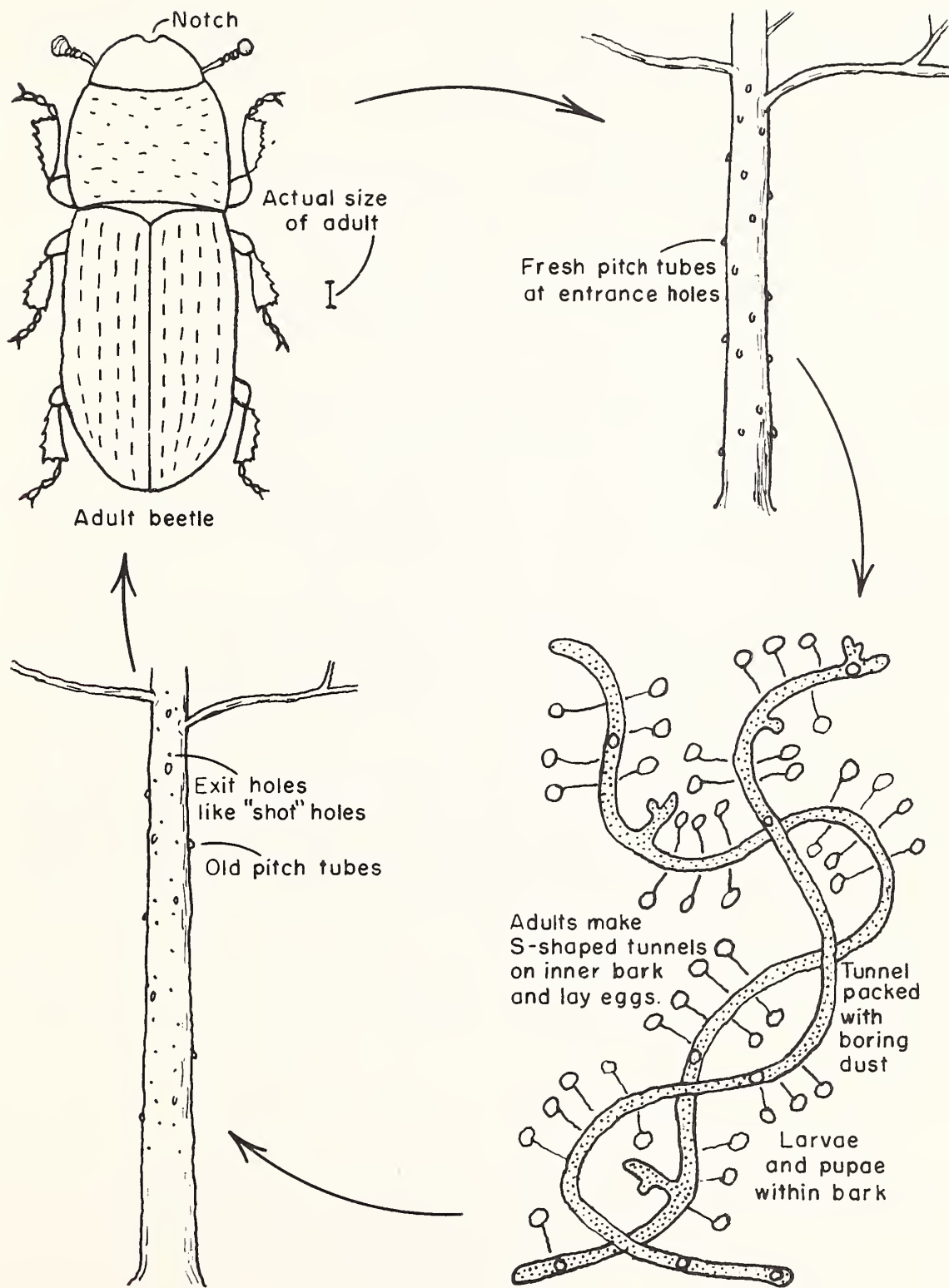


Fig. 2.— Southern pine beetle.

logging will check beetle populations only if the infested trees are cut and taken to the mill before the beetles have left. Slabs of infested bark knocked off in felling and skidding should be destroyed.

Where rapid salvage logging is impractical, the infested trees should be immediately cut and sprayed with benzene hexachloride (BHC). Only pines with living broods within them should be treated. These are usually green-topped or slightly faded trees.

The recommended spray for controlling the southern pine beetle is 0.25 percent gamma isomer benzene hexachloride in No. 2 diesel oil. This may be prepared in either of the following ways:

- a. Crush 2-1/2 pounds of 36 percent gamma isomer benzene hexachloride (technical grade) and dissolve by stirring it into two gallons of warmed diesel oil. Before the solution cools, pour and stir into about 48 gallons of oil. The finished spray costs about 17 cents per gallon. Technical-grade BHC is sold in 125-pound drums.
- b. Stir one gallon of benzene hexachloride emulsifiable concentrate (containing about one pound of gamma isomer per gallon) into about 50 gallons of No. 2 diesel oil. The spray costs about 19 cents per gallon.

The second formula, while more costly, is much easier to mix. BHC emulsifiable concentrate can be purchased in 5-gallon containers and 53-gallon drums. One gallon of the mixture will treat about 100 square feet of bark surface. All surfaces should be covered thoroughly--until drops begin to form and run off. Logs should be turned, if necessary, so that the underside can be sprayed.

CAUTION: BHC is poisonous. Keep it off the skin and away from eyes and nose. Wash carefully with soap and warm water after mixing or applying the spray.

IPS ENGRAVER BEETLES

Ips avulsus, Ips grandicollis, and Ips calligraphus

Importance. -- The 3 common species of Ips beetles kill sapling and larger pines that have been weakened by drouth, fire, hail, ice storms, or other causes. They can almost always be found in lightning-struck trees. Logging slash, fresh-cut logs, and fresh stumps are especially attractive to them.

Infested trees are typically scattered through the forest, but the beetles may kill clumps of trees when conditions are in their favor. Cumulative damage is very high, and is accentuated by the fact that the beetles carry a blue stain fungus that degrades the lumber cut from infested trees.

Habits. -- All three species girdle the cambial region, but they are unlike in size and they prefer different parts of the tree. Young adults are yellow, older ones nearly black.

Ips avulsus, the smallest species (1/8-inch long), attacks the crowns of large trees and the trunks of small ones. Populations normally build up in fresh logging slash and spread to crowns of nearby timber when logging ceases or when the standing trees have been weakened by drouth or some other disturbance. They sometimes kill one branch at a time but when abundant may suddenly attack the entire crown. When they are particularly active, they may make stands more susceptible to other Ips beetles and the southern pine beetle. This species has recently displayed signs of unusual aggressiveness. Landowners should take pains not to overlook it. Its presence in the crowns may not be noticeable except to an experienced spotter or with the aid of binoculars.

Ips grandicollis is medium-sized (about 3/16-inch long). It commonly attacks the middle and upper trunk. Ips calligraphus, about 1/4-inch long, generally prefers the lower trunk.

The three species may work together in the same tree, their tunnels overlapping, or they may work independently or in succession. They may also become associated with southern pine beetles and the black turpentine beetle. There may be 4 or 5 generations per year.

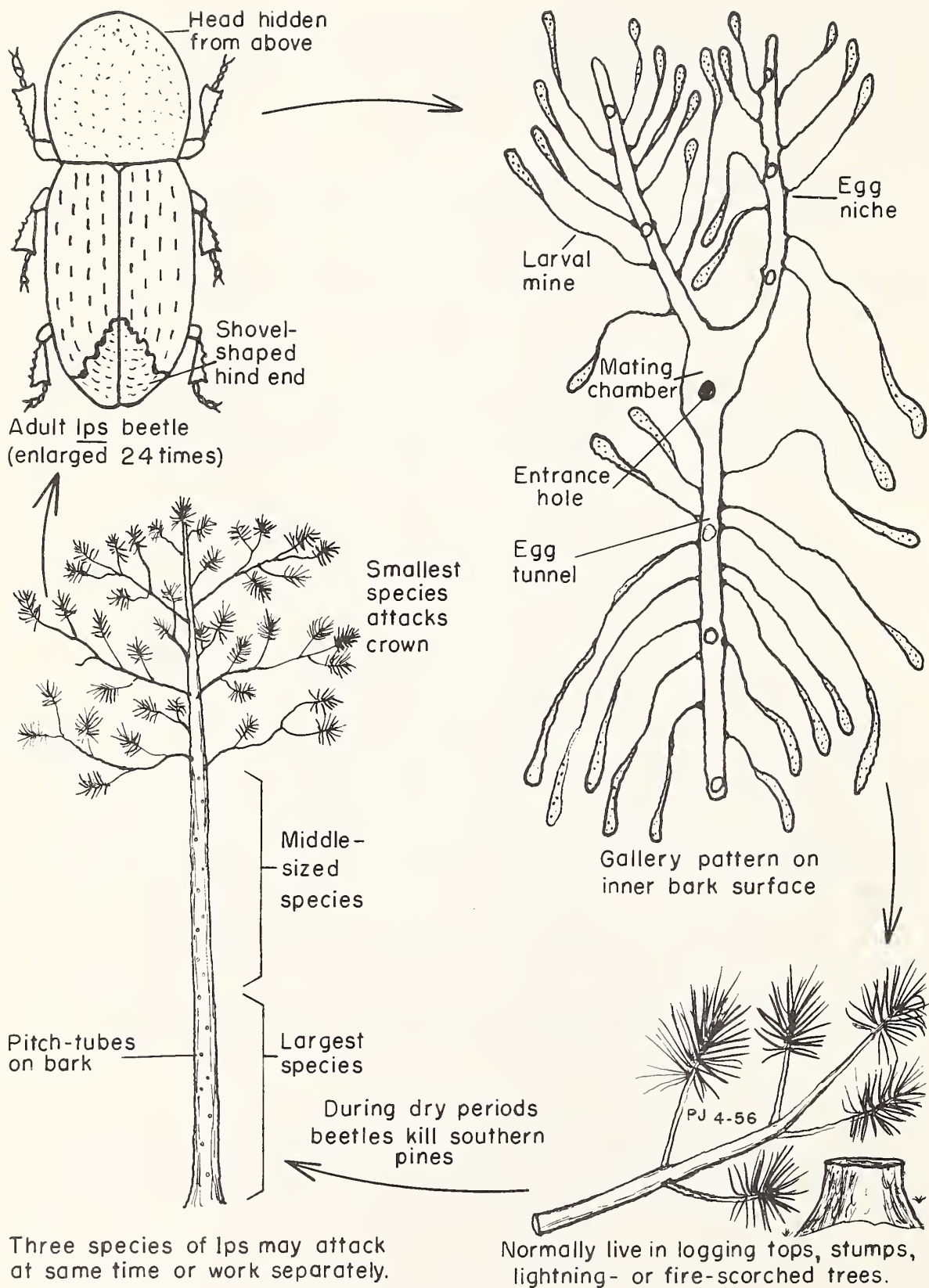


Fig. 3.—*Ips* engraver beetle.

Signs of attack. -- Trees infested with Ips will usually have numerous pink or red-brown (sometimes whitish) pitch-tubes, about the size of a wad of gum, on the bark of the branches or trunk. In trees of low vigor, however, pitch tubes may be lacking, and the earliest signs of attack will be reddish boring dust in bark crevices and in spider webs at the base of the tree.

If the crowns alone are infested, pitch tubes will be difficult to see and the foliage may be only a trifle faded when the broods are ready to leave. Sometimes the crowns turn yellow or red, limb by limb.

The egg tunnels, engraved on the inner bark and the surface of the wood, are more or less straight. They are typically Y- or H-shaped and run parallel to the grain of the wood. The egg tunnels are generally free of boring dust. Larval feeding mines--wavy, somewhat indistinct, and filled with boring dust--lead from the egg tunnels.

Control. -- When infested trees are widely scattered, control is generally too expensive to be practical. However, if the attack seems to be getting out of hand, infested trees should be salvaged before the beetles have left, and the slabs should be burned at the sawmill. Where early salvage is impossible, attacked trees should be felled and the tops, trunks, and stumps sprayed. This "cut-spray" treatment costs \$1.20 to \$2.50 or more per tree, depending upon the size and accessibility of the trees and the concentration of the outbreak. When logging in a drouth year or on poor sites, it is generally a good precaution to avoid intermittent cutting and to burn or spray the tops and slash immediately.

The BHC formulations recommended for the southern pine beetle will also control Ips.

The general strategy in control is to keep ahead of the insect by treating only trees that have broods in them. Usually crowns are still green or faded when broods are ready to leave. By the time the foliage has turned red, beetles have usually, though not always, left. Do not make the mistake of treating vacated red-tops and overlooking nearby infested green-tops.

Where drouth is the primary cause of unusual Ips beetle activity, soaking rains will generally stop the infestation.

CAUTION: BHC is poisonous. Keep it off the skin and away from eyes and nose. Wash carefully with soap and warm water after mixing or applying spray.

BLACK TURPENTINE BEETLE

Dendroctonus terebrans

Importance. -- Formerly considered of little importance, the black turpentine beetle has in recent years become a serious forest pest capable of killing the best trees in the stand. It is especially prevalent following fires, heavy cutting, drouths, and other disturbances to the forest. The increased use of mechanized logging equipment may have something to do with the insect's new importance, since heavy vehicles not only damage the residual trees but compact the soil and crush the roots.

Habits. -- The adults are dark-brown or black beetles 1/4- to 1/2-inch long. They bore into the cambial region and lay eggs there. The larvae, creamy white grubs up to 1/3-inch long, feed in groups on the cambium, side by side, and eat out large patches between bark and wood. When the attack is light the tree usually recovers. When beetle broods are numerous they girdle the cambium and the tree slowly dies. At least 2-1/2 months are required to complete the life cycle of the beetle. Usually there are about 2 generations a year, but broods overlap.

The adult beetles are attracted by fresh resin and skinned or severely scorched bark. Populations may build up in fresh stumps and then spread to living trees. The beetle appears to prefer trees on low, flat, normally wet or poorly drained sites, especially during drouths. It is also common along woods roads and trails.

Signs of attack. -- The most obvious signs of attack are conspicuous pitch tubes on the lower trunk and stumps. The tubes are large--sometimes about the size of a walnut--and white to reddish in color. Older tubes have a sugar-like texture. Granular pieces of hard, whitish resin will be found on the ground below the pitch tubes. The tunnels and irregular excavations beneath the bark are packed with sticky resin and red boring dust. When an attack is so far advanced that ambrosia beetles have entered the tree, the whitish boring dust of these beetles will also be seen around the base.

Crown foliage color is not a satisfactory clue to the activities of this pest, because heavy populations may occur before the trees are killed.

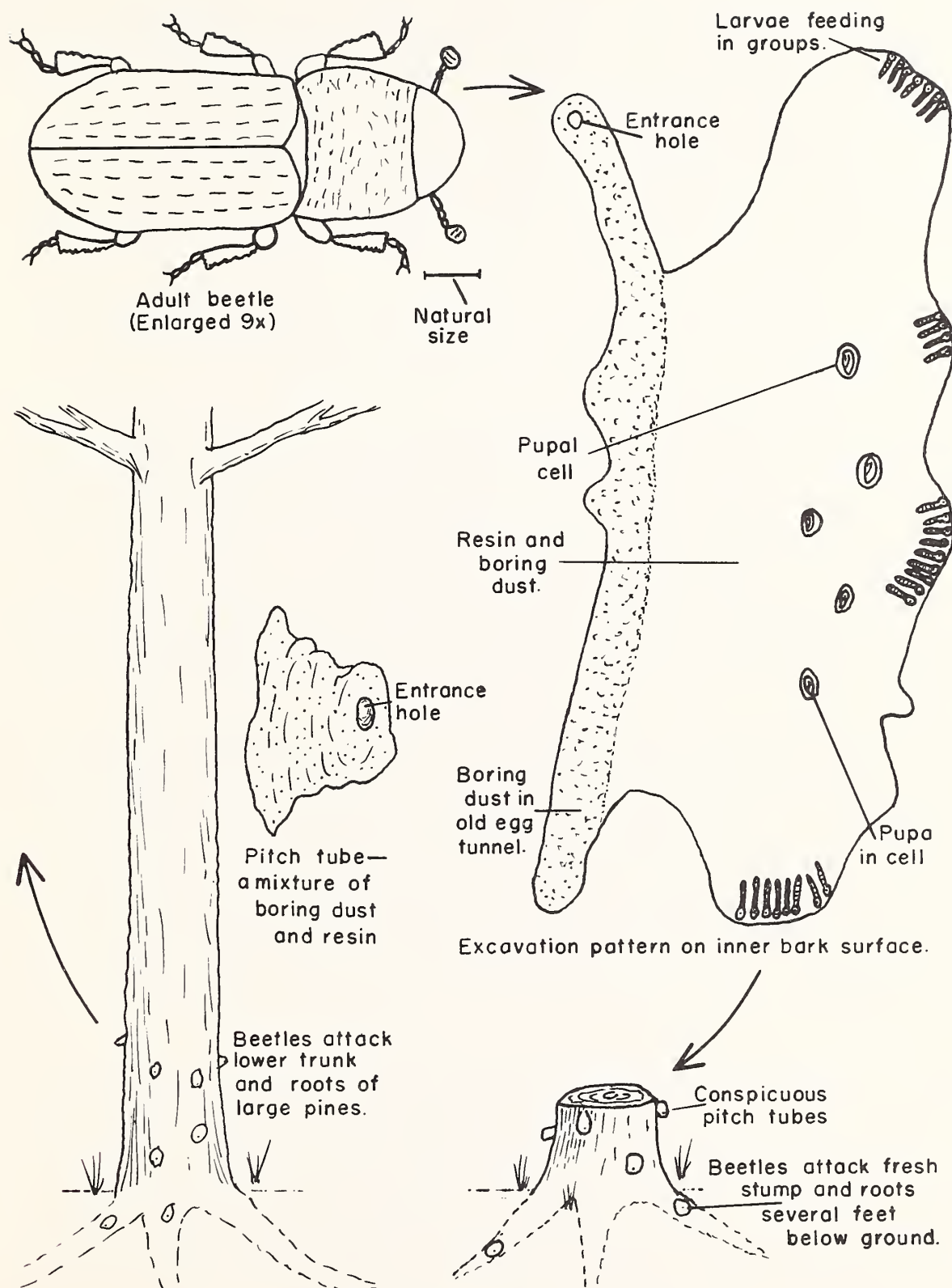


Fig. 4.—Black turpentine beetle.

Control. --Buildup to outbreak proportions is comparatively slow, and if stands are watched carefully, many attacks can be headed off. Unusual disturbances to the stand should be avoided, so far as possible. Logging should be done in such a way as to minimize injury to the remaining trees. If logging is carried on when outbreaks are likely, the green stumps and areas of skinned bark on remaining trees should immediately be sprayed with BHC. Spraying is especially useful where heavy logging equipment is used on poorly drained soils or where pre-cutting of polewood is done a few months before crop trees are removed.

Seed trees or other valuable trees in outbreak areas can be protected by spraying the lower 6 feet of the trunk and exposed roots with BHC; a single treatment will last 6 months or more.

If many trees are being killed or if large numbers of active pitch tubes indicate a rising population, control measures must be taken. Where the dying trees are too scattered to be salvaged, or when salvage cutting cannot be done immediately, the only recourse is to spray the stumps and infested butts of attacked trees with BHC.

Where salvage is feasible, the dead or dying trees should be cut and milled as soon as possible; the slabs should be burned in the millyard. Stumps and the butts of all remaining infested trees should be sprayed with BHC.

When trees are being marked for salvage, those that are completely encircled by active pitch tubes, and particularly those having the white dust of ambrosia beetles around the base, may be considered doomed to die. More lightly infested trees can often be saved by prompt spraying. Much sympathy is due the forester who has to decide which trees to cut and which to try to save. His task is somewhat easier if several salvage cuttings are possible within the year; then light marking can be used in the hope that many infested trees will recover. Where only one salvage cut can be made, heavy marking of infested trees may be necessary.

Sprays to be used on the turpentine beetle should contain two to four times the amount of BHC recommended for the southern pine beetle. All surfaces of infested bark and bark crevices should be sprayed to the point of run-off. Litter should be scraped from around the base of the tree or stump, so that the spray can penetrate the vicinity of the larger roots. The cost of spraying will be 10 to 30 or more cents per stump or butt, depending on the bark crevices, diameter, accessibility, and concentration of trees to be sprayed.

CAUTION: BHC is poisonous. Keep it off the skin and away from eyes and nose. Wash carefully with soap and warm water after mixing or applying spray.

PALES WEEVIL

Hylobius pales

Importance. --Adult weevils girdle pine seedlings planted or growing naturally in areas where older pines have recently been cut or killed by fire or other causes. The weevil is a pest in most of the eastern U. S., but is becoming more apparent and increasingly important in the South as a result of more widespread clear-cutting and planting practices. Two related species are involved, the deodar weevil (Pissodes nemorensis) and the little-known Pachylobius picivorus. Both of these closely resemble the pales weevil.

Habits. --The weevils are attracted to freshly cut pine stumps and scorched pine trees, and chew the tender bark of seedlings in the vicinity. They lay eggs in the root bark of stumps and scorched trees and possibly also beneath the bark of logs and slash. The larvae develop under the bark, and new adults emerge and again feed on nearby seedlings.

The adults are brown to black, 1/4-to 1/3-inch long, with a prominent snout. The grubs are creamy white and about 1/4-to 1/3-inch long. They make oval chip cocoons of finely shredded wood beneath the bark.

Signs of attack. --The weevils may eat patches of bark, or they may girdle the stem completely, often removing most of the bark. Attacked seedlings wither and die rather suddenly. Heaviest feeding is in the spring and early summer and again in the fall.

Control. --No thoroughly effective control is known. Investigations are being conducted to determine the relation of season of cutting to subsequent weevil damage. If cutting can be scheduled so that stumps will deteriorate before weevil flights occur, damage to planted seedlings or natural reproduction may be minimized.

Experiments are also under way to find a dip or spray that will protect planted seedlings. BHC and other chemicals have shown promise in limited tests already made.

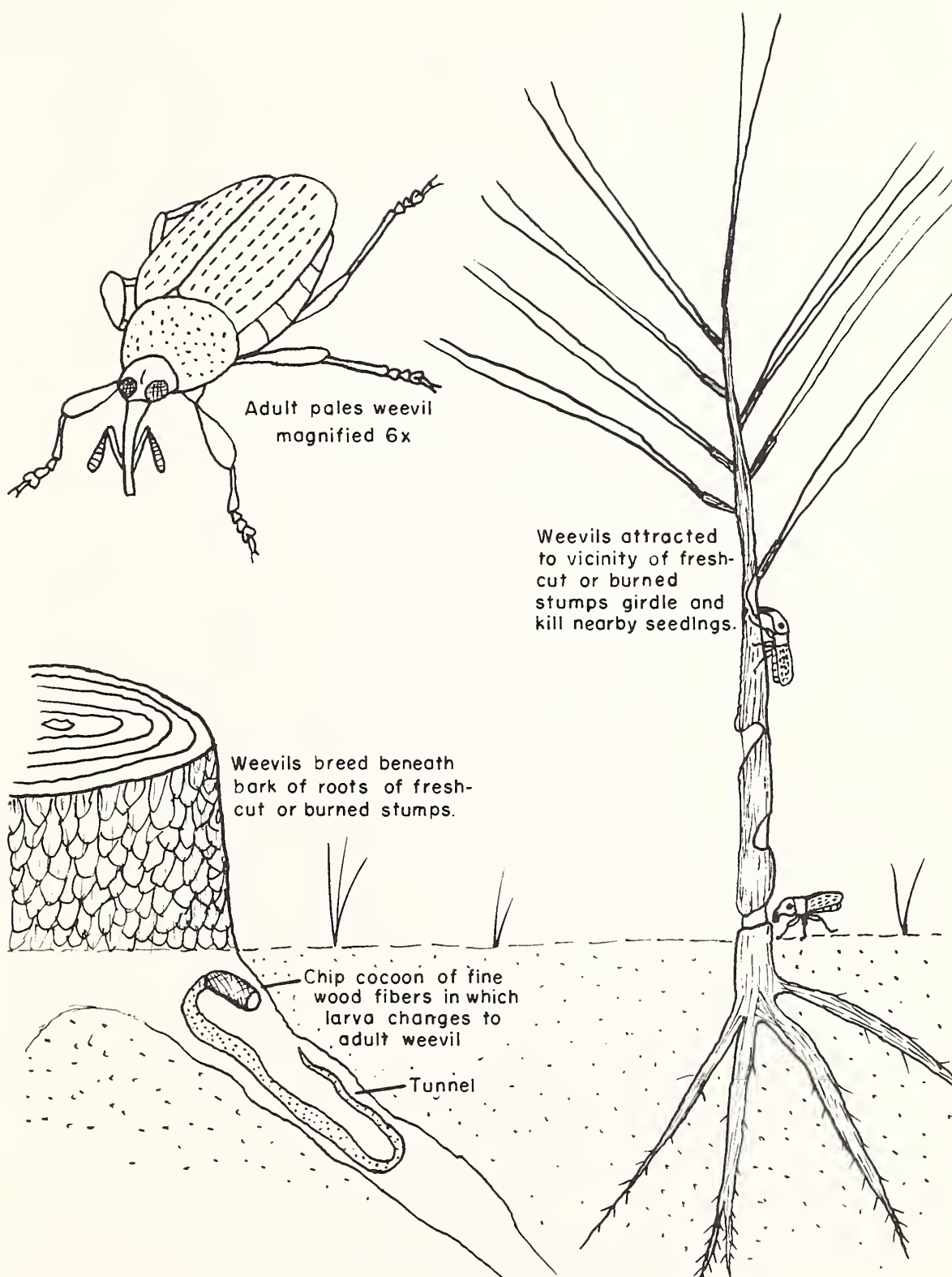


Fig. 5. — Pales weevil.

NANTUCKET PINE TIP MOTHS

Rhyacionia frustrana

Importance. -- The tip moth kills buds and twigs of planted and natural loblolly and shortleaf pine seedlings throughout the South. Long-leaf and slash pines are much less susceptible to injury. Vigorous seedlings may grow fast enough to overcome the effects of the insect, but severe and repeated setbacks may kill trees, especially those on poor sites. Pines 15 feet or more in height are usually not damaged appreciably.

Habits. -- The adults are about one-quarter inch long, copper-colored with silvery markings on their wings. They are active from February until late fall, but are not often seen unless disturbed. Eggs are laid on the foliage. The larvae are yellowish to pale brown, worm-like, and up to 1/3-inch long. They feed within the buds and twigs and later change into brown, capsule-like pupae about 1/4-inch long.

Signs of attack. -- Terminals and branches of infested pines have many brown, dead, hollow buds and stunted twigs. A crust of hard, whitish resin can be seen between buds, needles, and twigs; and the insides of dead buds and twigs contain granular, brown, manure particles. Trees that have been repeatedly attacked are likely to be bushy, forked, and stunted.

Control. -- The insect is so widespread that few young stands are entirely free of it. Control is difficult at all times, and unless it is a community effort the individual treated areas will soon become reinfested. The most feasible method of avoiding severe damage is to encourage rapid growth through the use of vigorous strains and by planting, where possible, on good sites. Infested nursery stock should not be planted.

Severely infested plantations can often be pulled through by watching for the first appearance of the moths on warm days in February or March and then thoroughly spraying the foliage with DDT. The spray is prepared by stirring 50 percent DDT wettable powder into water, in the proportion of 1 pound of the insecticide to 50 gallons of water. The suspension must be constantly agitated while it is being applied. Spraying in early spring will not prevent later infestation, but it will destroy most of the existing population and thus permit the trees to make a spurt of growth that will not be seriously damaged by attacks later in the season. Because broods overlap, spraying in summer is less effective.

First flight in February or March.
About 3 or 4 flights each summer.

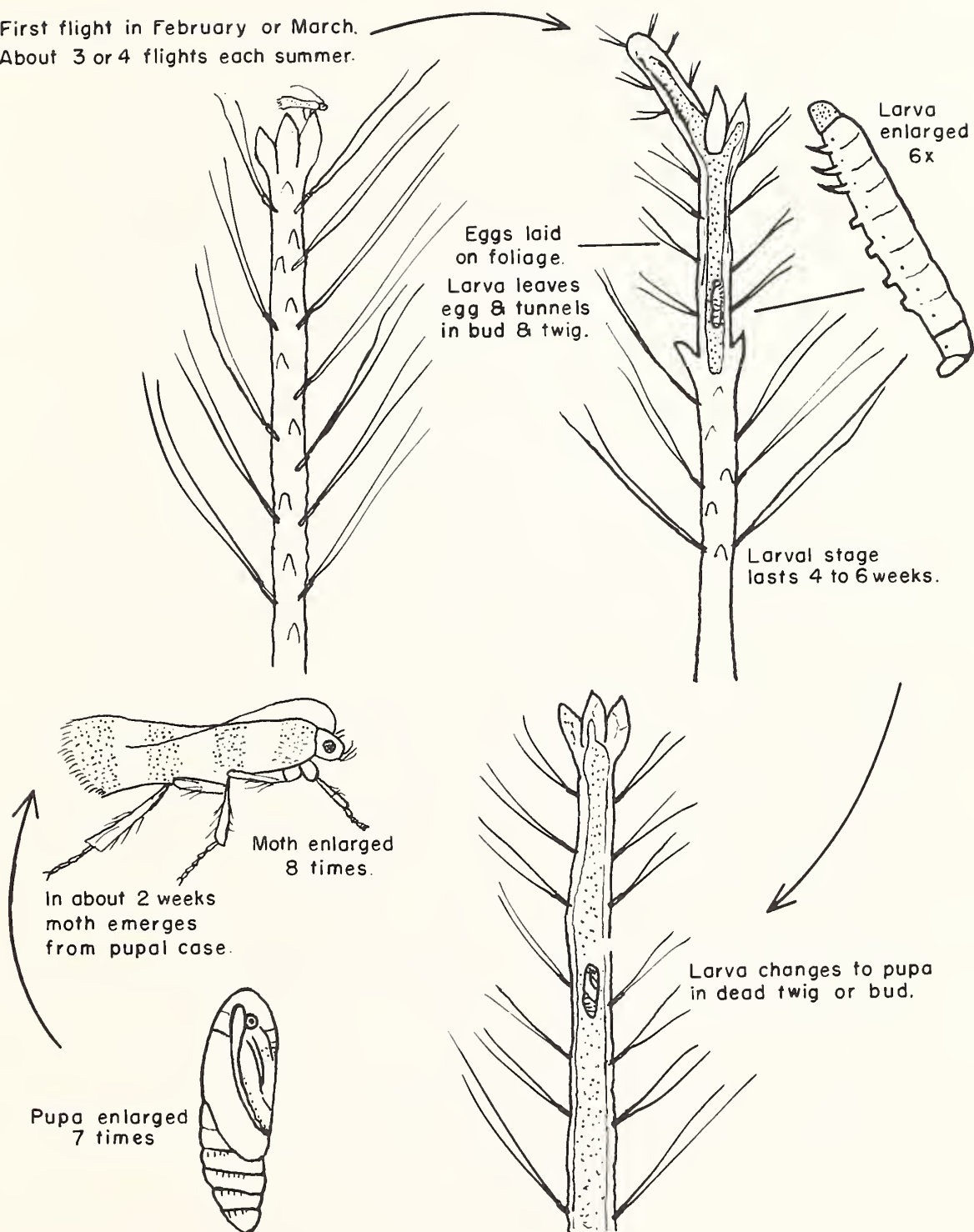


Fig. 6.—Nantucket pine tip moth.

PINE SAWFLIES

Neodiprion species

Importance. --At least three species of sawflies attack southern pines, the redheaded pine sawfly (Neodiprion lecontei), the loblolly pine sawfly (N. taedae linearis), and a little-known black-headed species, N. exitans. All have caterpillar-like larvae that chew the needles of pines of all sizes. Severe infestations will stunt or malform young trees and sometimes kill them. Larger trees suffer severe growth loss.

Habits. --The habits of all three species are similar. The adult female cuts slits in pine needles and deposits an egg in each slit. The larvae usually feed in clusters. When full grown they are almost an inch long and hairless; their color differs with the species (table 1). When fully developed, they make shiny-brown, oval cocoons about 1/3-inch long. The cocoons are usually in the soil or on it, less frequently in bark crevices or in the foliage. There may be one to several generations each year, depending upon the species.

Signs of attack. --The larvae themselves, their cocoons or fecal pellets under the tree, or the chewed needles and needle stubs are obvious signs of attack.

Control. --If defoliation is severe enough to warrant, infestations can be controlled by spraying with DDT, preferably when the larvae are young and more easily killed.

For aerial applications or truck-mounted mist blowers, dissolve 1 pound of technical DDT in a suitable solvent and dilute with fuel oil to make 1 gallon of insecticide: apply at the rate of 1 gallon per acre.

For garden or knapsack sprayers, mix 50-percent DDT wettable powder in water at the rate of 1 pound of powder to 50 gallons of water, and thoroughly spray all infested foliage. The mixture must be constantly agitated to prevent the DDT from settling out.

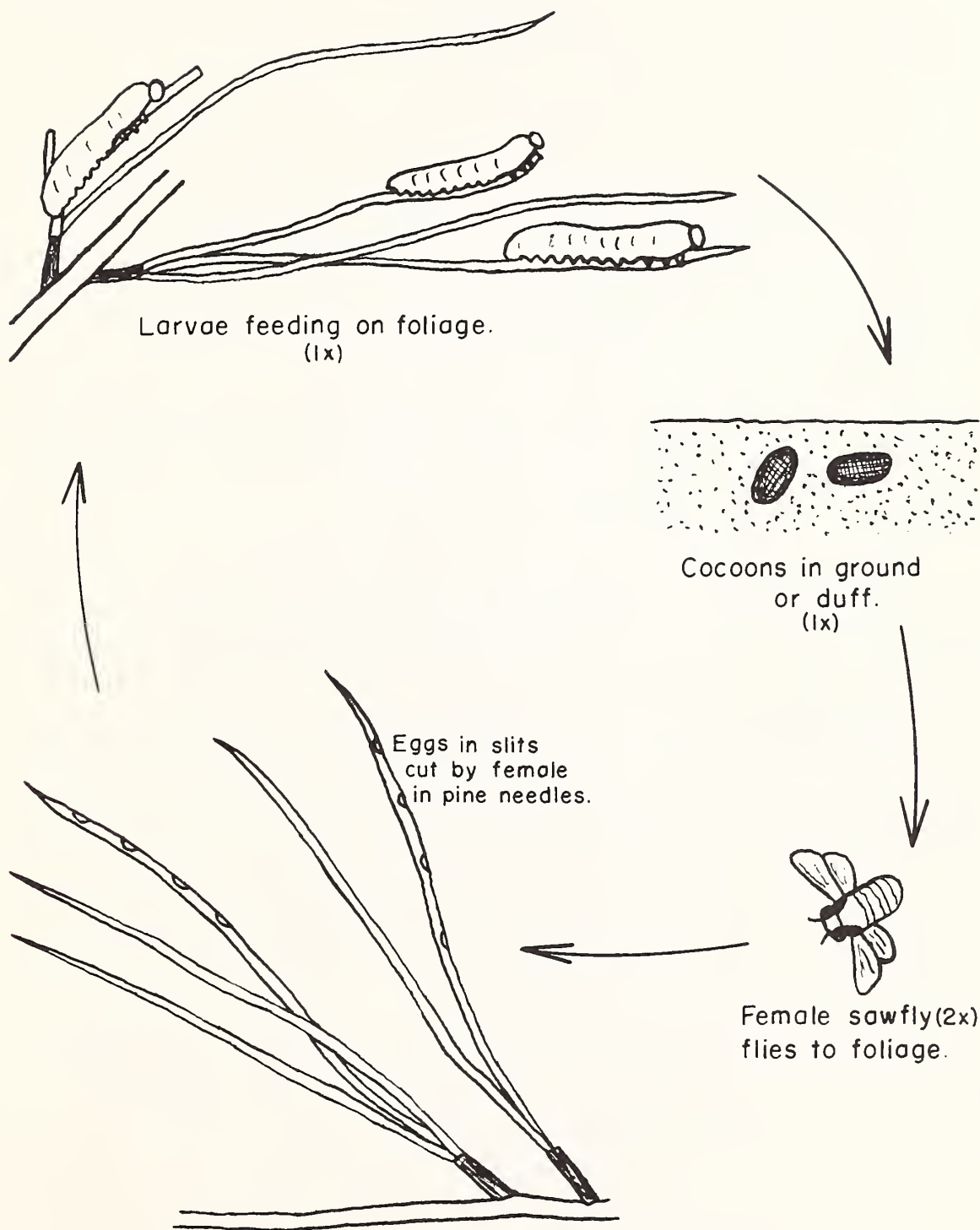


Fig. 7.—Pine sawflies.

WHITE GRUBS

Phyllophaga species

Importance. -- White grubs, the larvae of the common May or June beetle, are among the worst insect pests of pine nurseries. They also damage young pine plantations and natural regeneration in old fields or sod-land. It seems likely that grubs cause some of the mortality laid to drouth or vegetative competition.

Habits. -- Beetles appear in spring and early summer and feed on hardwood foliage. Females lay their eggs in the soil, and the larvae feed on roots of pine seedlings, grasses, and other plants. Grubs reach an inch or more in length. The life cycle varies from 1 to 3 years, depending on the species.

Signs of attack. -- Attacked seedlings wither and turn yellow or brown. Since the grubs destroy most of the roots, the dying trees can easily be pulled from the soil. The grubs can usually be found beneath the soil surface.

Control. -- Infested nursery beds should be treated, before sowing, with the equivalent of 10 pounds of actual chlordane per acre. Dusts, wettable powders, and emulsifiables have all been used with good results. To insure that the insecticide will penetrate the soil, it should be applied just before a rain or wet down promptly with the nursery sprinklers.

Seedlings should not be planted on severely infested grassland. Valuable planted seedlings may be protected by treating the infested soil with chlordane.

CAUTION: Chlordane is poisonous and should be handled with care. Keep the spray or dust off the skin and out of the eyes and nose. Bathe with plenty of soap and water at the end of the day. Wash contaminated clothes before wearing them again.

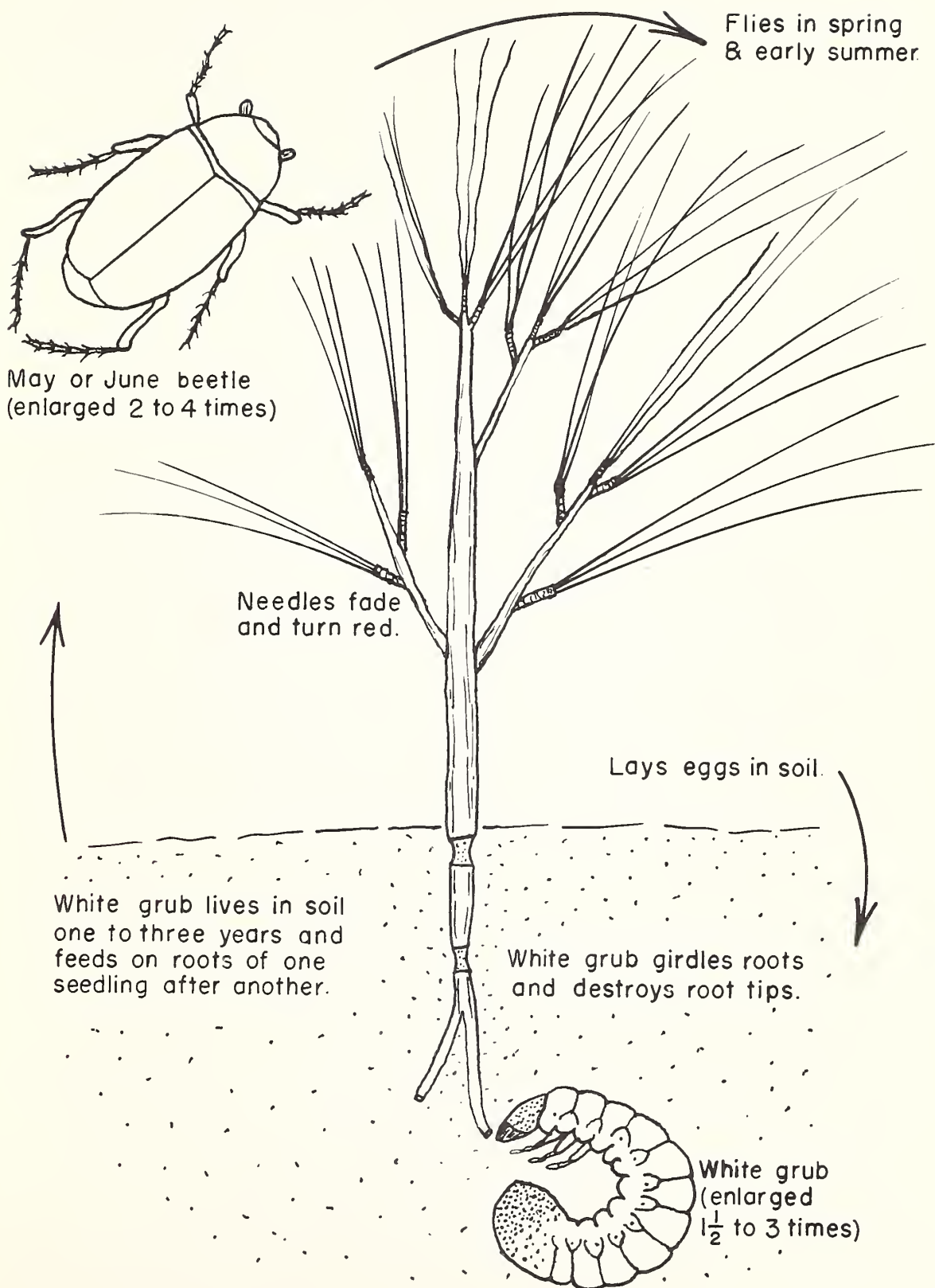


Fig. 8.— White grubs.

